

Typical Clean in Place Conductivity Monitoring System

The illustration above shows a typical conductivity monitoring system where ABB products are used to monitor and control the concentration of

caustic solution in the caustic bulk tank and also to provide control at the caustic/water cleaning interface.

Why use Conductivity Monitoring for Clean in Place Systems ?

The customer needs:

- ▶ To ensure the hygienic integrity of his product.
- ▶ To ensure the plant is maintained at the highest standards of hygiene.
- ▶ To minimise the amount of chemical reagent used and keep operational costs at a minimum.
- ▶ To reduce the load on the effluent plant.

Why use ABB Instrumentation ?

- ▶ Continuous on-line cell diagnostics – ensures integrity of system performance and generates security and confidence in the plant.
- ▶ Automatic cell fouling compensation – maximises performance and keeps maintenance costs to a minimum.
- ▶ Simple to setup, easy to use 'plug and play' system, requires no calibration on start-up.
- ▶ Inherent cell accuracy provided by proprietary manufacturing technique, ensures high accuracy cell constants and long term operational performance.
- ▶ Patented six-electrode cell enables in-spec performance even with up to 90% cell fouling.
- ▶ Direct contacting temperature sensor – provides rapid response temperature sensing which is vital to the accuracy of the conductivity measurement by optimizing temperature compensation.
 - Temperature errors can cause significant conductivity errors, e.g. a 20°C error (caused by slow temperature response on a caustic solution) could result in an error of 8mS/cm.
- ▶ PT1000 temperature sensor – allows longer cable runs without loss of accuracy.
- ▶ Well proven electronics incorporating the following features:
 - Backlit LCD ensures easy to read displays,
 - Simple programming procedures,
 - Concentration scales – allows direct readout in concentration of caustic (NaOH), hydrochloric acid (HCl) and sulphuric acid (H₂SO₄) as well as conductivity units,
 - IP66/NEMA 4X case – can withstand the most demanding environments, such as dairies and brewery process plant,
 - Multi-language software displays/messages – suitable for use around the world,
 - Programmable current output – choice of 0 to 10mA, 0 to 20mA and 4 to 20mA for customer flexibility,
 - Security code protection – prevents unauthorised tampering,
 - Prefixed temperature coefficient settings on concentration scales – the instrument automatically selects the correct coefficient, it knows the value and ensures accurate temperature compensation.

What ABB Products are Suitable ?

- ▶ **At the caustic bulk tank:**
 - 4621/500* Wall-mounted transmitter,
 - 2221/605 Dip multi-electrode conductivity cell,
 - 0235/820 Connection cable (max. length 100m).
- ▶ **For caustic/water interface detection:**
 - 4621/500* Wall-mounted transmitter,
 - *three models offer a remote range change facility:
 - 4621/500 SP15 for 0 to 10 and 0 to 100,
 - 4621/500 SP19 for 0 to 20 and 0 to 200,
 - 4621/500 SP28 for 0 to 25 and 0 to 250,
 when ordering, please specify the required range.
 - 2271/605 Screw-in, multi-electrode conductivity cell (or 2271/625 if hygienic fittings are necessary),
 - 0233/820 Connection cable (max. length 100m)

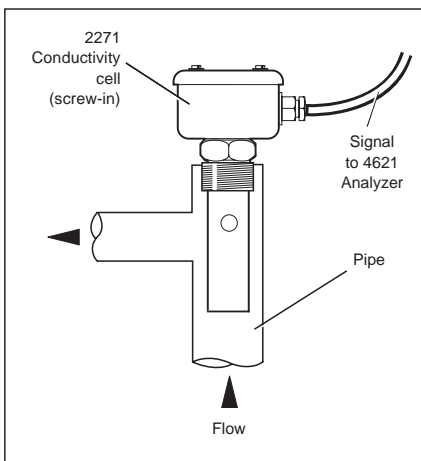
Associated Conductivity Monitoring Applications

- ▶ On effluent treatment plant – pH and dissolved oxygen equipment.
- ▶ In the boiler house – Zirconia O₂ measuring equipment, conductivity, monitoring the condensate return.

Multi-electrode conductivity products can also be used in applications which would otherwise be labour intensive, these include:

- ▶ *Automotive industry – phosphating bath,*
- ▶ *Metal finishing – rinse tanks,*
- ▶ *Sea water distillation – desalination,*
- ▶ *Semiconductor manufacture – water treatment,*
- ▶ *Water treatment plants – resin regeneration.*

Installation



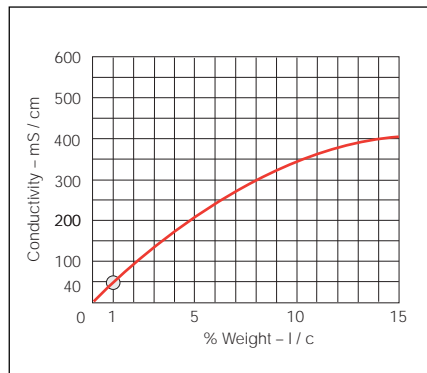
Screw-in Conductivity Cell
Fitted on Pipe Bend

Conductivity Cells

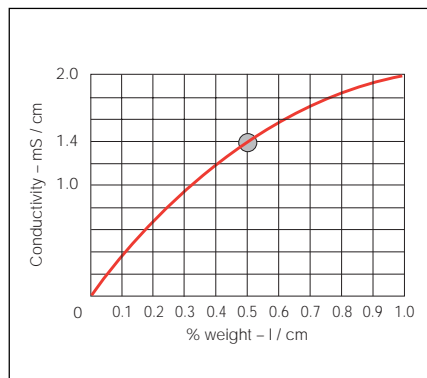
When installing a Clean in Place system the following installation procedures should be applied to ABB conductivity cells.

- ▶ Mount the flow cells (type 2241/605) vertically so that sample enters at the bottom of the cell and flows out through the top to avoid the risk of air bubbles.
- ▶ Install screw-in or hygienic cells (type 2271/605, 2271/625 or 2271/635) so that a representative sample always passes through the cell.
- ▶ On small pipelines mount the cell on a bend to ensure that sample passes through the cell (see figure opposite).

Process Description



Concentration of Sodium Hydroxide (NaOH) by Weight



Concentration of Phosphoric Acid (H_3PO_4) by Weight

Electrolytic Conductivity

Electrolytic conductivity is used extensively throughout industry for a wide range of applications. These range from quality control through to chemical dosing as a method of protecting plant life, optimizing chemical consumption and generally providing a good financial return.

Conductivity measurements are temperature sensitive and accurate results can only be obtained by using automatic temperature compensation (standard in ABB multi-electrode cells) and referring the measurement back to the international standard of 25°C. Although the strength of the caustic used varies from plant to plant, it is generally in the region of 1% (equal to approximately 40mS/cm). The use of multi-electrode based systems provides the most reliable performance when measuring caustic solution of this strength.

Monitoring the Caustic Bulk Tank

The concentration of caustic in the bulk tank is monitored and controlled by a multi-electrode dip cell and associated conductivity analyzer. This concentration may vary due to evaporation and/or the addition of make-up water. If a change is detected by the cell, the analyzer activates a caustic make-up solution tank outlet valve which opens to introduce further caustic into the bulk tank, thus maintaining the concentration.

Caustic/Water Interface Detection

Similar equipment is used for water/caustic interface detection. Caustic solution is pumped around the process pipework to sterilise the system and a screw-in or flow line conductivity cell is fitted in the cleaning loop as a monitoring device.

After a preset cleaning time, the caustic is returned to the bulk tank by the introduction of mains water which is pumped around the system to flush the caustic through. The conductivity cell detects the difference between the caustic and water (caustic is typically 40mS/cm, water >1mS/cm) and activates an in-line three way valve to open, which diverts the water to the effluent plant.

This process ensures that the maximum amount of caustic is returned to the bulk caustic tank and at the same time, reduces the load on the effluent treatment plant.

Using Phosphoric Acid as an Alternative Solution

Phosphoric acid (which has a typical strength of 0.5% concentration – this equates to 1.4mS/cm.) can be used periodically, possibly weekly, to ensure the plant is thoroughly clean.

If used, a remote range facility is necessary on the analyzer to ensure accurate conductivity measurements. This facility is available on the 4621/26 analyzers. Two ranges are available: 0 to 10mS/cm and 0 to 100mS/cm or 0 to 20 and 0 to 200mS/cm.



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